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<p>Gaza Local Industrial Estate Initial Engineering Assessment</p>

SUBMITTED ON

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TO THE

USAID MISSION TO THE WEST BANK AND GAZA
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BY

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1. Introduction

The PRIZIM project is assisting PIEFZA in evaluating several potential Local Industrial Estates (LIEs). Initial sites are being identified in Rafah, Gaza City, and Nablus. PRIZIM project support includes an initial evaluation of these potential LIEs to arrive at a project description, cost estimate, demand estimate, and pro forma financial performance calculation for each LIE.

The purpose of this assignment is to assist the team in developing the project description for the LIEs, and to carry out the cost estimation for the development of each proposed LIE.

EMCC was contracted by TSG to carry out an initial engineering study for the proposed Gaza Local Industrial Estate site.

The main focus of this study is to provide information about the project that will allow decision makers to prioritize the different LIE proposals. This includes a technical project description and cost estimates.

The location of the site was identified in coordination with PIEFZA and the Municipality of Gaza (MoG) and in consultation with the PRIZIM Project. The total area allocated for the industrial area is about 73ha. An area of 10ha was also selected for the initial development phase of the GLIE.

2. Site Description and Existing Physical Infrastructure

2.1 Introduction

This chapter presents the assessment of existing site conditions and existing infrastructure of the proposed site for the local industrial estate in Gaza. The assessment includes:

- Basic geography and physical characteristics of the site and the surrounding area
- Utilities infrastructure and services (both existing conditions and expansion opportunities)
- Transportation network

2.2 Site Location, Physical Features and Population

Location

The proposed site for Gaza Local Industrial Estate falls within the jurisdiction of Gaza Municipality. Gaza City is situated in the north part of Gaza Strip¹, and bounded by the Mediterranean Sea to the West, The Green Line to the East, Wadi Gaza to the South, and Jabalia town to the North (see Figure 2.1).

The proposed site for Gaza Local Industrial Estate is located at the northeast administrative boundary of Gaza City. It is about 7 km far from Erez Industrial Zone at the northern borders between Gaza Strip and Israel, about 5 km from Gaza Industrial Estate, about 40 Km from Gaza International Airport and about 13 km from the proposed Gaza Seaport. The proposed site is close to two urban centers, Gaza City and Jabalia Town. It is about 4 km from the downtown of Gaza city and 2km from Jabalia center.

Size & Ownership

The area allocated by the master plan prepared by the Municipality of Gaza to be used as an industrial area at the northeast border of the city of Gaza is about 68.7ha. It consists of Block number 909 parcels number 1 and 2 and part of parcels 3, 4 and 5, as well as parcel number 1 of block number 750. It is named as the First Industrial Area in Gaza City. The decision was taken in July 13, 1997, and was approved by the Higher Planning Council of the Ministry of Local government in July 27, 1997.

The total piece of land belongs to the Islamic Waqf, which is managed by the Ministry of Al Waqf and Religious Affairs (MoWRA). It has a total area of 73ha.

¹ An area of 365 km² populated by about 1.1 million, is located along the southeastern edge of the Mediterranean Sea coast

Gaza Local Industrial Estate Engineering Study



A memorandum of understanding has been recently signed between the MoG and the MoWRA about the future development of the industrial area in Gaza. According to this memo the MoWRA would hand the piece of land to the MoG and the MoG will be responsible for the planning and development. However, both parties would share the revenues and responsibilities.

The total area of land (73ha) was leased to five different users by a public auction. The lease contracts were due to end by the 30th of June 1998. The average rate for lease was \$280/ha/year. Table 2.1 shows the names and the area of land leased to each party.

Table 2.1 Names and area leased to each party

Name	Leased Area (ha)
M. Habeeb	25
A. Al Fayyomi	15
M. I. Abed	9
K. Helless	9
Al Sakhra Foundation	15
Total	73

Source MoWRA

Part of the land is used as a cattle farm. The other part is used for growing vegetables such as tomatoes, green pepper, ... etc. This is in addition to growing some Guava trees. Many green houses are built on the southern part of the land. New green houses are also being built. Figure (2.2) shows the total area that belongs to MoWRA and the existing users.

Figures 2.3 - 2.6 present recent photographs that describe the existing land use at the site.

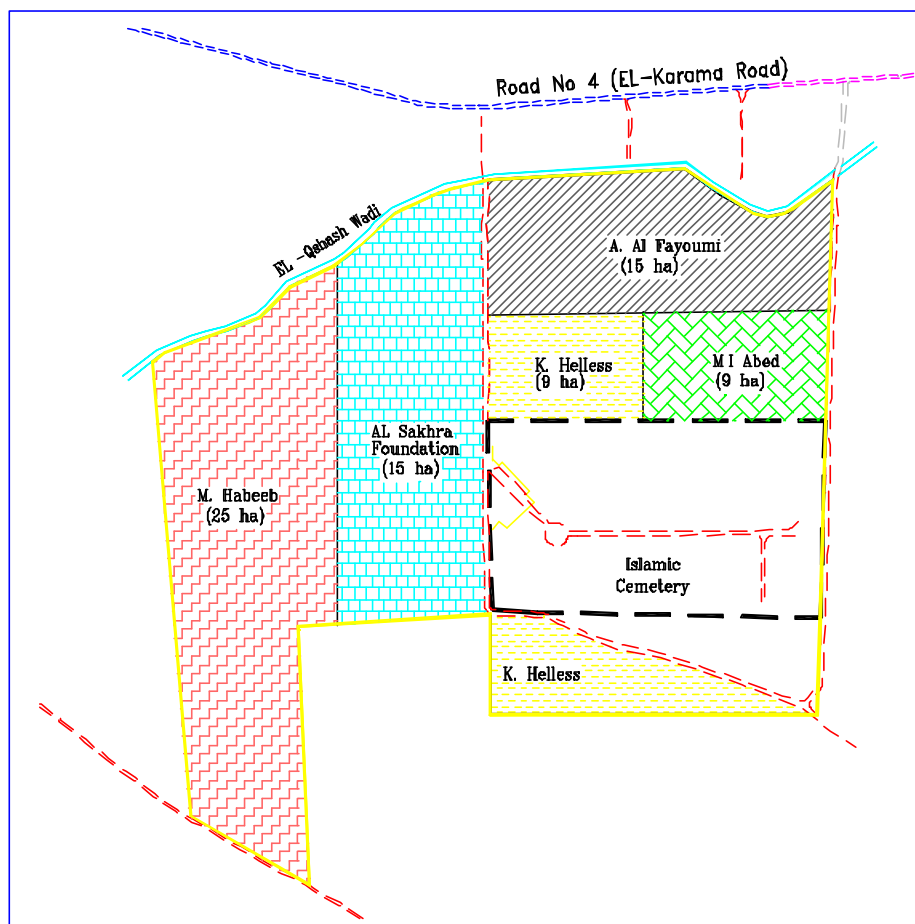


Figure (2.2) The area owned by MoWRA and the existing land users.



Figure (2.3): The existing agriculture activities in the proposed site.



Figure (2.4): The main entrance of the proposed Industrial Estate crossing with El Karama Road.



Figure (2.5): Green Houses on the southern part of the site.



Figure (2.6): The boundary of the Islamic Cemetery in the surrounding of the proposed site.

Population

The 1997 census estimated the total population of the Gaza Strip at about 1,001,120 inhabitants of which 359,941 live in Gaza Governorate. As for the rest of Gaza Strip, it is assumed that the population growth rate for the first five years will remain at its current rate of about 4% (UNSCO, 1999) while it is expected to decline in the following five years to about 3.7%. The decline is associated with higher costs of living and increased education and awareness levels.

Table 2.2: Distribution of population by area (1997)

	Urban	Rural	Camps	Total
Population	291596	6309	62036	359941
% of the Total	81%	1.8%	17.2%	100

The level of urbanization in Gaza Governorate is the highest among other communities in the Gaza Strip.

Water Table

The coastal aquifer is the main source of water in Gaza Strip with a long-term sustainable yield of about 60 Mm³/year. The groundwater table is located at a depth ranging from few meters at the west to about 70-90 meter from the ground surface at the east.

At the proposed site for GLIE, the ground water table is located at around 48-50m below the ground surface. The depth of water table has been estimated from the static water level of wells Q54-A and Q54-D, which are located within the site. The measured static water levels at the cited wells are 49.36 and 48.26m from the ground surface respectively. Figure 2.7 shows a section in the aquifer in the northern part of Gaza Strip, which is close to the proposed location of GLIE.

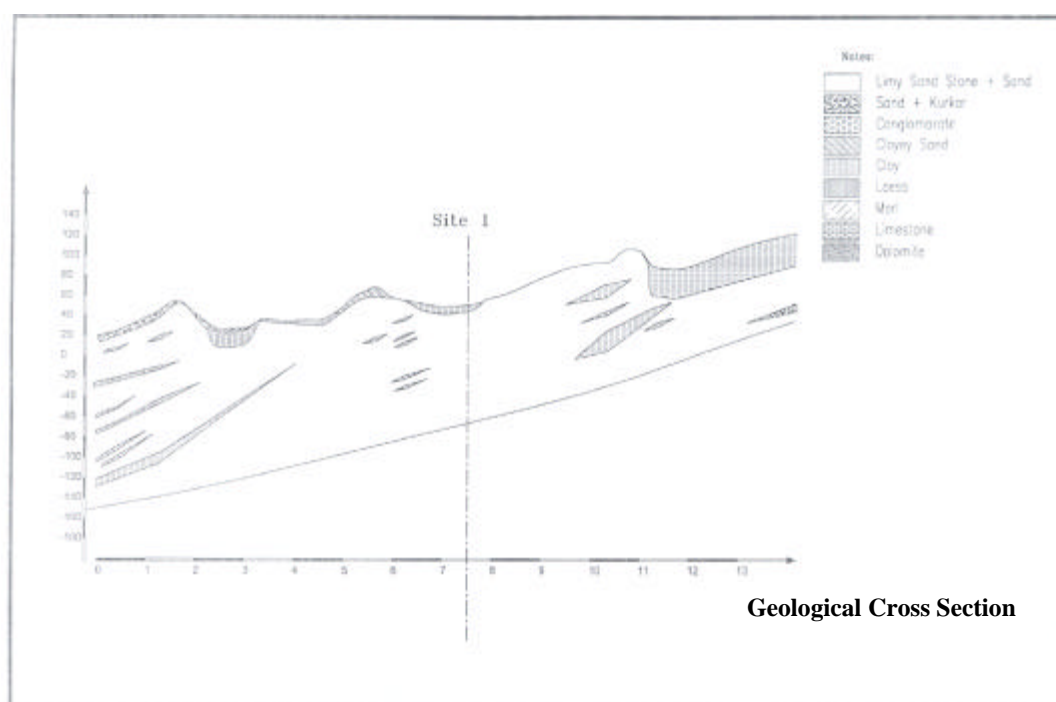


Figure 2.7: Cross section of the aquifer at Gaza North area

2.3 Topography, Soils, and Drainage

Topography

The area proposed for industrial development is located at an intermediate elevation from the sea level with an average elevation of about 50m above the mean sea level. The area is almost flat and gently sloping towards northwest with a maximum level of 54 at the southeast to a minimum level of 45.75 at the northwest corner, as shown in Figure 2.8.

The concerned site is bounded with a natural Wadi (stream) about 3-4 m deep located at the west edge of the site. This Wadi (named El Qashash Wadi) conveys storm water that is collected from its catchments area inside Israel and Gaza Strip and discharges it into the sea to the west. The width of the Wadi varies along its route and it is about 5-6 m at the GLIE site. It has been noticed that construction wastes and debris material have been dumped into the Wadi.

Soils

The soil investigation report that was prepared for the proposed treatment plant site, which is adjacent to GLIE site, indicates that the first layer stratum is stiff silty clay. This layer is located immediately below topsoil and has a depth of about 7-23m below

ground level. Below the clay, the Kurkar formation was encountered consisting of fine to medium grained sand, with minor amounts of gravel and silt.

Drainage

As mentioned earlier in the site topography, the area is gently sloping towards the northwest leading to El Qashash Wadi. The contour lines of the area are shown in Figure 2.8. This Figure shows that, in general, the northwest side of the proposed GLIE is the lowest part of the area. The Wadi provides a natural drainage to the site, however, in some wet seasons, the surrounding areas have been subjected to flooding from the Wadi.

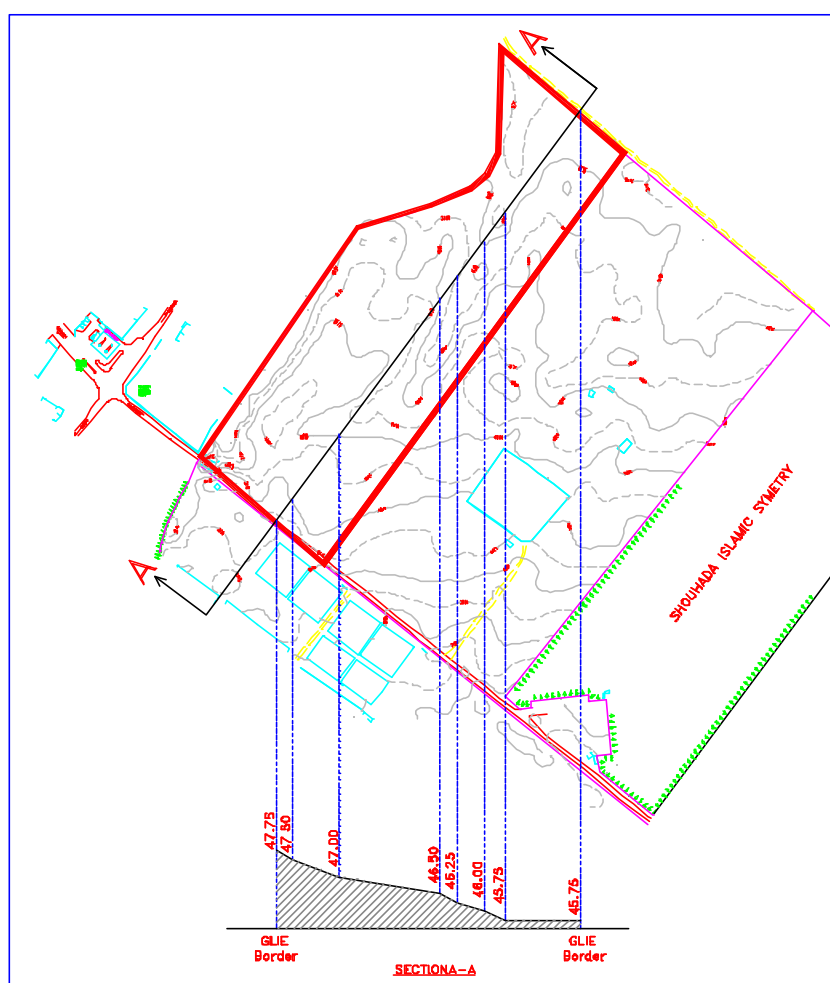


Figure 2.8: The Contour Lines of the GLIE

2.4 Existing Road Network

The proposed GLIE is conveniently located to the extreme northeast end of Gaza City. It is not far from the Beit Hanoun (Erez) crossing to Israel.

Table (2.2) shows the distance between GLIE and other locations:

Table 2.2: Distances from the proposed GLIE

Location	Distance in km.
Sofa Crossing	36
Rafah International Crossing	44
Gaza International Airport	40
Karni Crossing	4
Gaza Industrial Estate	5
Proposed Gaza Seaport	13
Beit Hanoun (Erez) Crossing	7
Ashdod	43
Hebron	56
Ben Gurion Airport	75
Jerusalem	90
Ramallah	90
Nablus	120
Haifa	160
Amman, Jordan	150

A detailed master plan was prepared by the MoG on May 12, 2001. This master plan describes the existing and proposed road network for this part of Gaza city around the concerned area. This plan is yet to be officially approved. The following information are taken from this detailed master plan.

Regional Roads

Salah El Din Street is the main regional road in Gaza Strip. This 30m wide road passes through Gaza Strip from Beit Hanoun (Erez) crossing in the north to El Awda Crossing at the international borders with Egypt. Starting from Beit Lahia City (north of Gaza) this road splits into two. The western part keeps its name as Salah El Din Street while the eastern part is called El Karama Road. El Karama Road passes too close to the proposed GLIE site (about 140m). Currently it has about 8m width of pavement. However, it is planned to be widened for up to 53m. El Karama Road rejoins Salah El Din Road at El-Shuhada Intersection (near Nitzarim Jewish Settlement). Figure 2.9 shows the Proposed and Existing Roads Leading to and Crossing the GLIE.

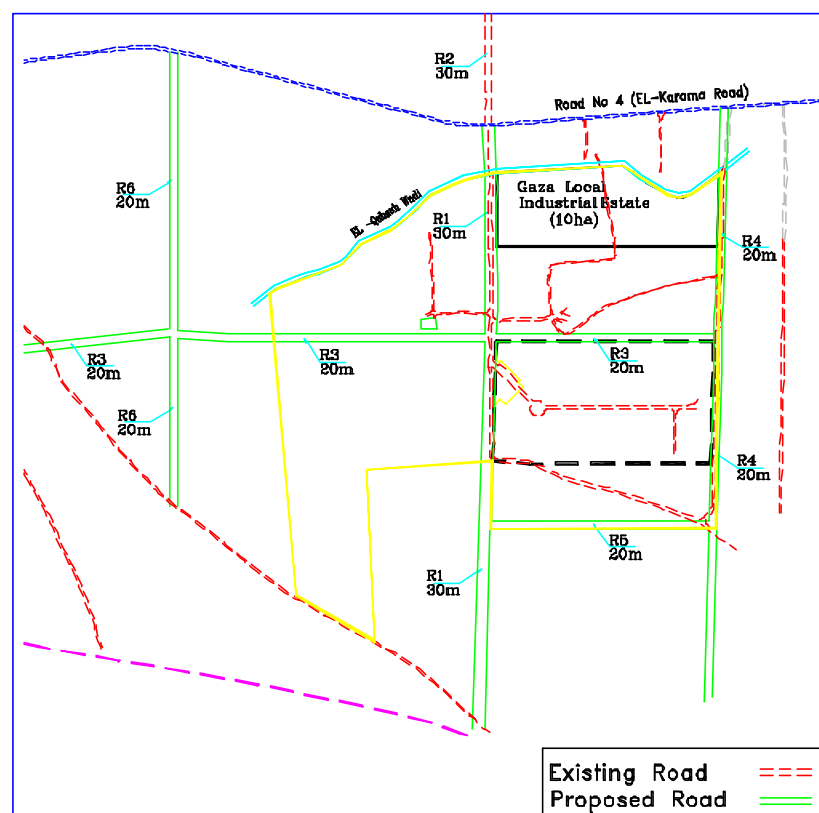


Figure 2.9: The Proposed and Existing Roads Leading to and Crossing the Proposed GLIE

Main Roads

Road R1

The main access road to the proposed GLIE site is the Shuhada Islamic Cemetery Street. It branches from El Karama Road. It is planned to be a 30m wide road. Currently it is constructed to have only 8m of paved width.

Road R2

Saleh Dardoana Street is a 30m wide road, which leads to the proposed GLIE site from the west and it connects the site with Salah El Din road.

Proposed Roads by MoG

Road R3

This road is proposed by the detailed master plan prepared by the MoG. It crosses the Industrial Area from the north to the south and continues south reaching the existing Gaza Industrial Estate at Karni. It is planned to be 20m wide.

Roads R4 & R5

These are two suggested roads by the MoG. Each has a 20m width. See Figure 2.7.

Road R6

This is another 20m wide road which is suggested by the MoG detailed plan. It is located to the south of the site.

Green Belt

A green belt is suggested by the MoG master plan around the whole local industrial estate. Its suggested width is about 20m.

2.5 Water Supply and Wastewater Treatment

Water Supply

Currently, the proposed site does not have a municipal water network. There are 5 agricultural wells drilled within the entire site boundary. The wells are designated Q54-A, B, D, and E, see Figure 2.10. Only two wells (Q54-A and Q54-D) have chemical analyses for the water quality. The last chemical test results show that the chloride levels is about 370 mg/l, which is above the WHO maximum Standard (250mg/l). The nitrate content is of acceptable levels (less than 50 mg/l).

Three major users are currently using the wells. The first one is a farmer named Al Fayyomi who has a lease contract with the owner of the land (Al Waqf administration). This farmer is extracting his water needs from one well (Q54-A) for irrigation and livestock. The second user is the Islamic Cemetery, which has one well designated Q54-B. The third is Al Sakhra Foundation, which has livestock farms and green houses. It is not known what wells are being used by this establishment.

A Municipal pipeline of 8" in diameter is passing along road No 4 and connects a municipal well in Jabalia with a residential area in Gaza City. The pipeline is about 200m to the west from the proposed site and has a capacity of 200m³/hr. The information obtained from Gaza Municipality demonstrates that it is not allowed to supply the proposed GLIE with water from this pipeline.

Wastewater

The area that is located to the east of Road No.4, including the proposed site for GLIE and the neighboring areas, is not served with a conventional sewage system. In the city of Gaza, about 85 percent of the residents are serviced with a sanitation system.

The nearest point at which sewage network exists is located 1.5kms to the south from the proposed site. However, the capacity of this sewer may not be adequate to receive the generated wastewater from the GLIE.

The sewage collected from Gaza is discharged to a treatment plant at Sheikh Ejleen area, 10 km to the southwest from the GLIE site. The daily influent that comes to Gaza Wastewater Treatment Plant (WWTP) is about 40,000 m³/day. According to MOG, the design capacity of the treatment plant is 40,000m³/day.

Within the Coastal Aquifer Management Program (CAMP), USAID has agreed to fund the extension of the WWTP to be capable of treating 75000m³/day. The project is now in the design phase.

According to a recent study carried out by a Swedish consultant, it has been decided to construct a new WWTP with a capacity of 34,000 m³ as a first phase to serve the three Northern Gaza Governorates. The selected and approved site is located 500ms to the east of GLIE site. A Swedish consultant has been contracted to conduct the detailed design for the WWTP and the associated works. The consultant is expected to start the assignment in August 2001. According to the Palestinian Water Authority schedule, the WW treatment Plant is expected to be functioning by 2005.

2.6 Electricity Supply

Gaza Strip is currently supplied with electricity from Israel through 11 high-tension lines (22 KVA each). Two of those lines are allocated for use of the Israeli settlements and 9 high-tension lines are supplying the residents of Gaza Strip. The maximum permissible load for each of the above high-tension lines is 11MW. Five high-tension lines are feeding the Gaza City in addition to the Northern Gaza Governorate. The nearest high-tension line is 1.5kms from the GLIE site and known as EL Sha'af Line. The second closest high-tension line is located along Salah El Dein road 2kms to the west of the GLIE site. The Palestinian Energy Authority acknowledged that the existing high-tension lines that feed Gaza are at present overloaded and do not have the capacity to meet any additional demand.

2.7 Telecommunications

Based on information provided by the Palestinian Telecommunication Company, there is a main Fiber Optic Cable located at Salah El Dein road 2 kms to the west of the GLIE site. There are also telephone conduits installed at Salah Dardouna

Road that connects Salah El Dein road with road No. 4. The end of these conduits is 200m from the GLIE site. The existing fiber optic cable and the conduits are shown in Figure 2.10.

There are also telephone conduits installed at Saleh Dardouna Road that connects Salah El Dein road with road No. 4. The end of these conduits is 200m from the GLIE site. The existing fiber optic cable and the conduits are shown in figure 2.10.

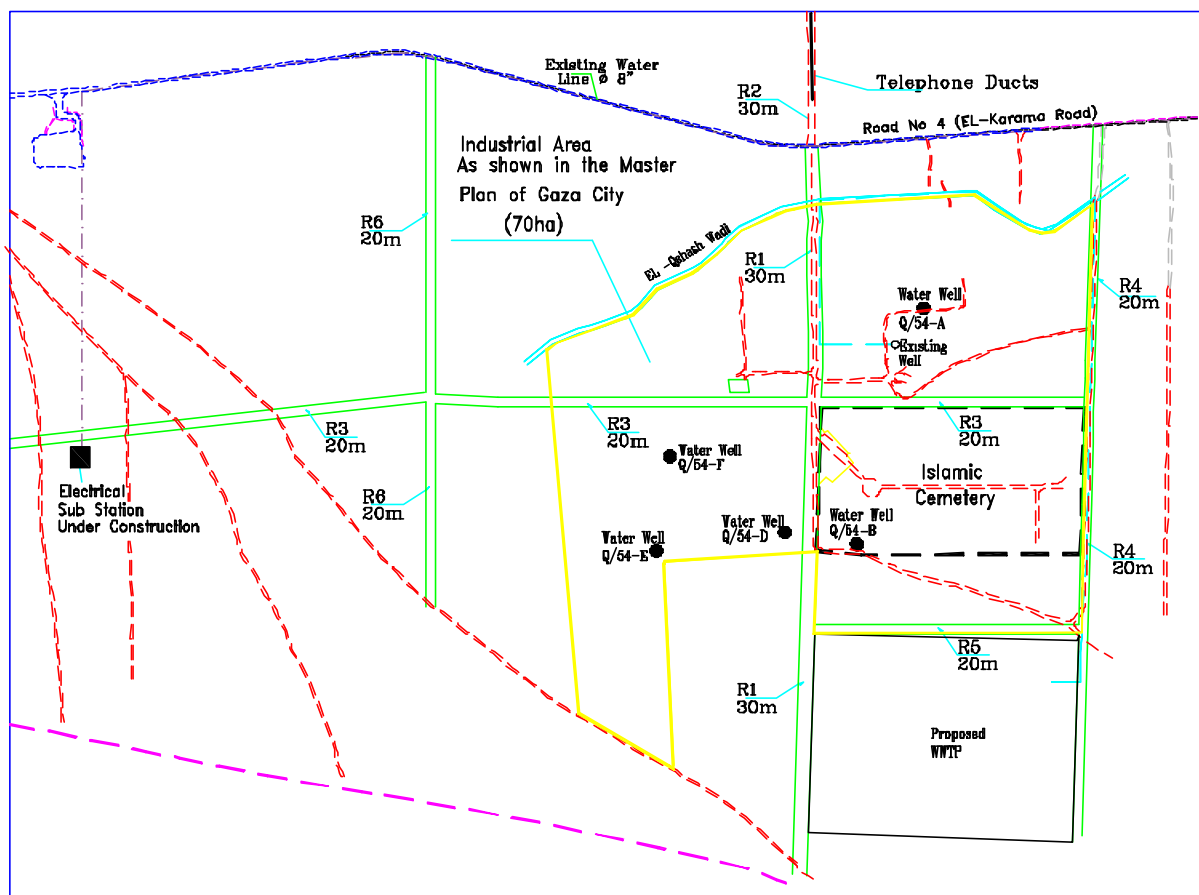


Figure 2.10: Existing Offsite Infrastructure

2.8 Solid Waste

In Gaza Strip, there are four landfill sites; one serving Gaza City, one serving the Middle Governorate, one serving Rafah Governorate, and one serving the Northern Governorate. Also, in Gaza City, there is a hazardous solid waste landfill, which serves the whole Gaza strip.

The nearest landfill site to the proposed GLIE site is the one that serves Gaza Governorate and is located about 4.5 km to the south of the proposed site and managed by Gaza Municipality.

The existing landfill site is expected to accommodate the solid waste for the coming 7 years. As per the Gaza Municipality, the cost of transportation, treatment and disposal of each ton of solid waste from the GLIE is US\$18.

2.9 Existing Structures on the Proposed GLIE Site

There are a few existing structures on the entire proposed site for GLIE. These include:

- A sheep farm (about 6,600m²);
- A cow farm with associated structures and six greenhouses
- Three wooden sheds (3x3m)
- 5 Water wells

However, the proposed first phase of 10 ha is free of any structure.

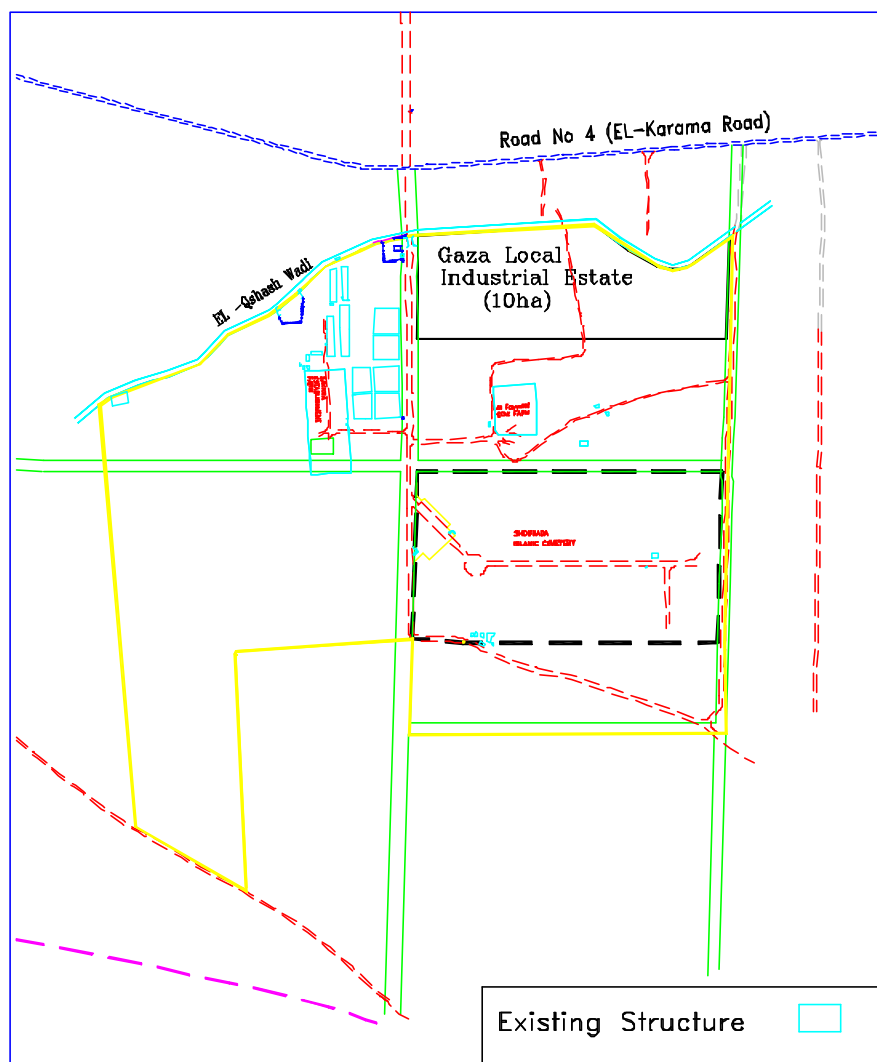


Figure 2.11: Existing Structure at the proposed GILE Site

3. Development of the GLIE

3.1 Introduction

This section describes the requirements for the initial development of the GLIE. It describes the proposed area for this phase of development and the percentage of land used for plots and for under roof areas. It also describes the required internal roads on site.

3.2 Initial Development Phase

In coordination with the PRIZIM Project and PIEFZA it was agreed to limit the size of the initial development phase to an area of 10ha.

Two options were suggested by the EMCC for the location of the 10ha within the whole area owned by the MoWRA and assigned for industrial development by the MoG. Option one was chosen parallel to the Islamic Cemetery Street. The second option was selected to be parallel to El Qashash Wadi and has a main access from the Islamic Cemetery Street. This can also be accessed from the R4 Road, which is planned by the MoG. The second option was selected in consultation with the PRIZIM Project and PIEFZA being closer to El Karama Road, has a better orientation, and is almost free from any existing constructions (see Figures 3.1 and 3.2).

3.3 Results of the Market Demand Analysis

A survey on the Marketing Demand for the Local Industrial Estate in Gaza was conducted by Massar Associates for the PRIZIM Project and for PIEFZA.

The survey examined the demand for an LIE on the proposed site.

The survey population included the following types of industry:

- Manufacturing
- Wholesale and retail activities (motor repair, crafts and ceramics)
- Transportation, storage and communications
- Real estate, rental / leasing activities and other business activities.

The above survey gave the following results about the areas currently used by industries.

Table 3.1: Frequency of areas currently used by industries

Area m2	Frequency	Percent	Mean area m2
0-150	111	56	103
151-300	40	20	221
301-450	8	4	379
451-600	15	8	500
>751	24	12	2,086
Total/Average	198	100	408

The above table indicates that more than 55% of industries used an under roof area of about 100m². The rest used larger areas with a maximum mean area of about 2,100m². The average area indicated by the above table is about 408m².

The survey concluded that most businesses would require a small to medium areas. The following table summarizes the results.

Table 3.2: Frequency of areas required by Businesses

Area m2	Frequency	Percent	Mean area m2
0 –100	16	9	86
101-200	63	36	179
201-300	25	14	270
301-400	5	3	400
401-500	37	21	500
501-600	2	1	600
>600	28	16	1934
Total/Average	176	100	541

The above table indicates that the areas provided in the GLIE should be of various sizes. However, the majority should have an area between 100 to 300m². The above table indicates that the average area required is about 541m².

The survey also suggests that the tendency to relocate under current situation is the highest among industry and manufacturing followed by services.

It also suggests that the larger the business in terms of the number of employees, the higher the interest to move to the GLIE.

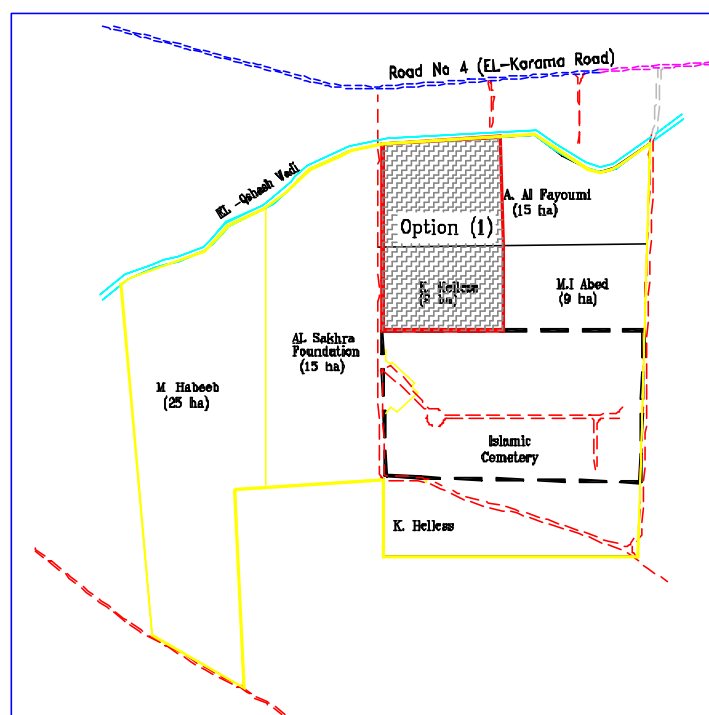


Figure (3.1): the Proposed Option 1 for the GLIE

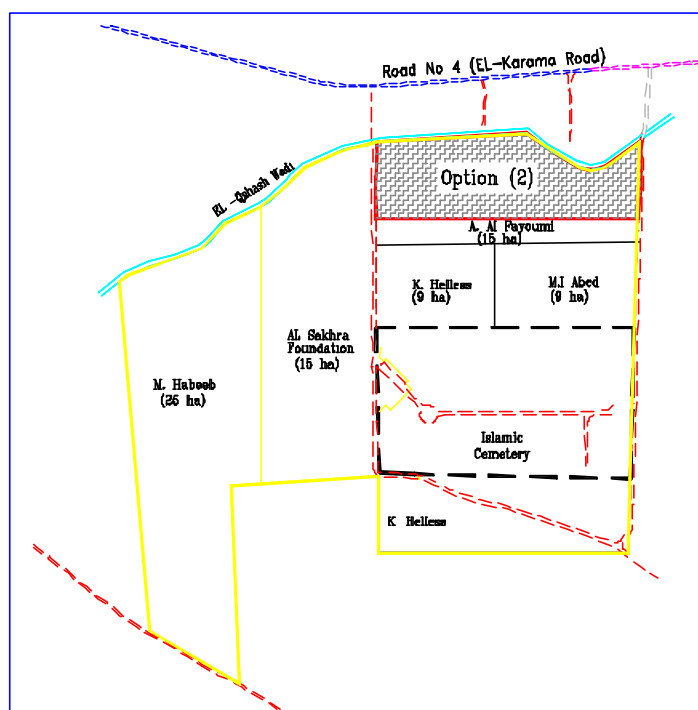


Figure (3.2): the Proposed Option 2 for the GLIE

3.4 Planning of the Gaza Local Industrial Estate

This study suggests that the Master Plan for the GLIE should be prepared taking the following criteria into consideration:

- Maximization of Land Use
- Minimization of Total Cost
- Minimization of Environmental Impacts
- Allowing for future expansion

3.5 Main Components of the Proposed GLIE

The main components of the GLIE are:

- Industrial plots
- Administration building
- Utilities and services
- Roads and car parks
- Green area.

Ratios Used in Planning

The total area available for development is 73 hectare. The initial phase has an area of only 10ha. The following ratios are suggested for land use:

- The ratio of serviced land to raw area was taken as 65%. Thus, common areas including administration buildings, roads, parking areas, green areas and engineering utilities were planned to occupy about 35% of the total area.
- The ratio of under roof area to serviced land was chosen to be 65%.
- The ratio of under roof area to raw area is about 42%.

The above ratios were selected based on the previous experience of the EMCC team as well as ratios used in similar other industrial areas, and in coordination with the PRIZIM Project and PIEFZA.

Setbacks

For all buildings the following setbacks are proposed as a minimum:

Front setback: 5 m
Back setback: 2 m
Side setbacks: 2 m

Based on the market demand survey and the ratios used in planning, it was found that a plot size of 1000m² would be appropriate. This will yield an under roof area of about 648m² per

plot. This area can either be used for one factory or, on the other hand, can be divided between two or more industries. The minimum under roof area that can be given by this planning scheme is about 81m^2 . The following table gives details about the possible areas that can be used by this scheme. It also gives the possible number of units for each area based on the market demand survey results. However, this scheme is very flexible and the choices for the size of the factory are almost open. The average under roof unit size produced by the suggested scheme is about 240m^2 . Figure 3.3 shows a suggested preliminary layout for the initial phase development.

Table 3.3: Possible divisions of area and number of units.

Possible area m^2	Possible No. of units	Total Area m^2
81	40	3,240
162	90	14,580
324	15	4,860
486	20	9,720
648	2	1,296
1944	4	7,776
Total	171	41,472

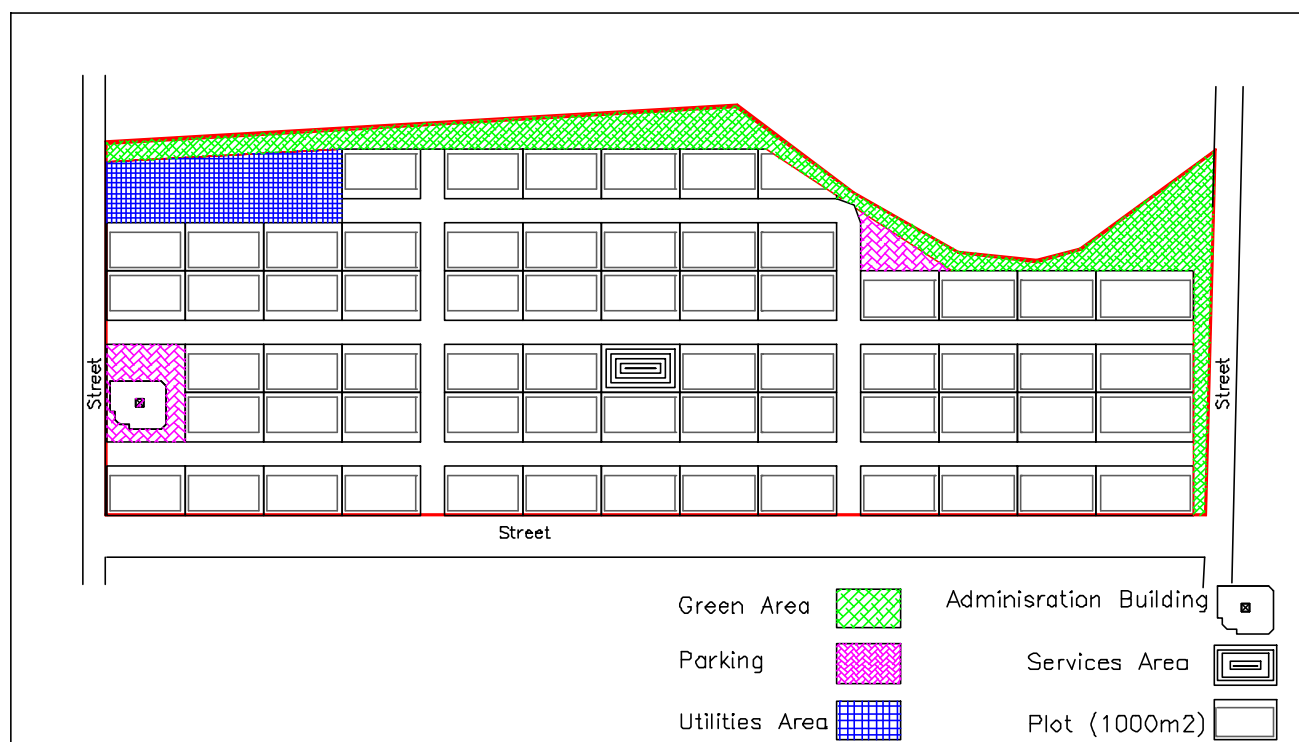


Figure 3.3 the suggested preliminary layout for the initial phase development

4. Infrastructure Developments

This section discusses the required infrastructure developments at the proposed GLIE. It deals with both offsite and onsite developments.

4.1 Water Supply and Wastewater Treatment

Water Demand

The planning and design of both the onsite and offsite water supply system will mainly depend on the projection of the water demand for the first phase of the GLIE.

Water demand estimates are based on the parameters applied in similar developments in the region. It is assumed in this study that the GLIE targets dry industries that are not large water consumers. The water demand is composed of two major components; the first is the domestic and industrial demand, and the second component is the fire demand.

Domestic and industrial Water Demand: The records of water consumption in the two industrial areas in Gaza Strip (Beit Hanoun and GIE) indicate that the water consumption is 5.3 and 3.8m³/day per dunum of building area in the two areas respectively. According to United Nations Industrial Development Organization (UNIDO) report of 1997, the estimated water demand for dry industry is 4m³/day/dunum of building area. This estimate is quite comparable with the actual consumption of the two industrial zones mentioned earlier. Therefore, the water demand that will be used in the planning of GLIE infrastructure is 4m³/day/dunum of building area.

According to the development ratios, the building area to the raw area will not exceed 0.45. This means that for the first phase of 100 dunum (10ha) raw area, the under-roof land will be about 45 dunum. Subsequently the total water demand will be 180 m³/day.

Fire fighting Demand: According to the Palestinian Water Authority guidelines for design of water supply, sewer and storm run off pipes, the necessary water for fire fighting ranges from 43 to 86 m³/h for small industrial and business areas. Considering an average value of 60m³/h for GLIE with minimum fire duration of 2 hours, the total fire fighting demand will be 120 m³. This reserve amount will be considered in the sizing of water tanks.

Gaza Local Industrial Estate Engineering Study

Water supply

Meeting the above water demand can be made from one of the existing wells at the project area. Assuming the yield of the well is 50 m³/h, then the operation of the well for 6 hours will be sufficient to meet the total daily demand.

The investment cost required to provide the GLIE with water comprises the following components:

1. The rehabilitation of the existing well.
2. The installation of 160mm in diameter UPVC pipe from the well to the elevated tank with a length of 300 m.
3. The construction of an elevated tank with a capacity of 300 m³ and height of 30 m above grade level.
4. The distribution system that comprises the installation of 1450m of 160mm diameter UPVC pipes in addition to valves, fittings, fire hydrant and air release valves.

The investment cost needed to cover the above-mentioned components is summarized in Table 4.1 below.

Table 4.1: Investment costs for water works

Activities	Unit Price US\$	Quantity	Sub-Total Cost US\$	Operation & maintenance/ year
Well rehabilitation	15,000	1	15,000	10,000
Trunk line 160mm UPVC	15	300 m	4,500	100
Water tank 300m ³ capacity and 30 m high	350,000	1	350,000	3,500
Water distribution network Piping 160mm in diameter UPVC including valves & fittings	20	1,450m	29,000	650
Fire hydrants	250	13	3,250	
Sub-total			401,750	14,250

Wastewater System

The generated sewage from GLIE will be collected by gravity and disposed off at the lowest point at GLIE area, which is located at the northwest corner. Assuming that the ratio of the generated sewage is 0.80 of the water consumption, then the total amount of sewage is

144 m³/day for the first phase. The treatment of the collected sewage can be made by two different options.

Option 1: The first option is to construct onsite treatment plant to only serve GLIE. The treated water produced can be used for irrigating the green areas inside GLIE. It can also be used by the farmers who have agricultural land in the vicinity of the GLIE site. In wet seasons where treated water may not be accommodated by the farmers or inside the GLIE site, the treated sewage can be disposed off into the nearby wadi that neighbors the GLIE.

The components of this option are the treatment plant, a pumping station for discharging the treated sewage to the reuse locations and a pressure pipe with 160mm diameter for restricted irrigation.

The most practical and feasible alternative for the treatment process that fits the small sewage flow is the Sequential Batch Reactor (SBR). It should be mentioned that this option and regardless of the cost issue has potential problems. These problems are mainly sludge treatment and the operation and maintenance of the treatment plant.

On the other hand, if a central treatment plant will be constructed near the project site as planned, the onsite treatment plant can be used for the pre-treatment of the generated sewage, thus minimizing the loads on the main treatment plant.

Option 2: This option is pending the operation of new Northern Gaza WWTP. In this option, the collected sewage will be pumped out to the planned main treatment plant 500 m to the east of the GLIE site. This WWTP is expected to be functioning by the year 2005. The disposal of the GLIE sewage entails the construction of sewage pumping station and 500m of 160mm UPVC pipe. The reuse, the sludge treatment and the operation and maintenance for the treatment plant, will no longer be of concern because these matters will be dealt with at the main WWTP.

The capital cost for the two options is summarized in Table 4.2.

The disposal of the raw sewage to new Northern Gaza WWTP will entail some fees per cubic meter of sewage.

Table 4.2: Capital Cost for Sewage Disposal Options

Item description	Capital Cost for Sewage Disposal US\$	Operation & maintenance cost/year
Option 1		
Treatment plant (200m ³ /day)	300,000	20,000
Pumping station for treated sewage Q= 130m ³ /day & H=15 ms	300,000	9,000
Pressure line 1000ms long, 160mm diameter UPVC for reuse of treated water	15000	300
Total of Option 1	615,000	29,300
Option 2		
Pumping station for raw sewage Q= 144 m ³ /day & H=15 ms	350,000	10,500
Pressure line 500kms long, 160mm diameter UPVC for discharging raw sewage.	7500	150
Total of Option 2	357,500	10,650

Evidently, the capital cost of Option 2 is about 60% of Option 1. The pumping energy cost will be almost the same in the two options, because both the pumped flow and the head are almost the same. In option 1, there is still an additional operation and maintenance cost to be considered for the SBR plant. However, the applicability of option 2 is pending the implementation and functioning of new Northern Gaza WWTP.

For the financial analysis, the most expensive option (onsite WWTP) would be assumed.

Onsite Water Supply and Wastewater

Water supply

The onsite water supply system comprises the construction of an elevated tank, and the distribution network. The design of all the components of the water supply system has been based on the following assumptions:

- At least one-day storage capacity including the industrial and fire fighting demands should be secured.
- The water that comes to the site from the nearby well has to be collected in the elevated tank.

- The elevated tank would be high enough to supply the first phase of the GLIE with water by gravity.
- A provision for a ground tank should be made for the future to cover the demand of any possible extension. In that case, a booster pump station would be needed to discharge water from the ground reservoir to the distribution network.

Design criteria:

The following design criteria have been used in the planning of the onsite water distribution system:

Hydraulic design equation is Hazen William equation

$$V = 0.85 C R^{0.63} S^{0.54}$$

Where:

V= velocity (m/sec)

C= Roughness co-efficient

R= Hydraulic Radius (m)

S= Hydraulic Gradient (m/m)

- The value of C =150 was used for UPVC pipes
- The maximum velocity is 1.5 m/sec
- Minimum pressure at any point is 20m
- Peak factor is 2
- The consumption of the water is assumed to be during 10 hours a day, thus the average hourly demand is derived by dividing the daily demand by 10 hours.
- Pipe Material will be UPVC
- Fire hydrants will be provided at distances not exceeding 100 ms with a capacity of 60m³/h.
- Pressure rating of the pipes and ancillary fittings will be 10 bar.

Configuration of the network

Based on the above assumptions and design criteria, the components of the water supply system have been designed as follows:

- Elevated tank with a capacity of 300m³ and height of 30ms located at the utility area. The elevated tank is made of reinforced concrete and has a circular cross section.
- The water network comprises distribution pipes 160mm in diameter. The size of the 160mm has been selected to cope with the fire demand.

- All the distribution network will be installed underground along the roads. The water pipes will be located in the sidewalk with a minimum cover of 0.8m. Wherever the pipes are laid under traffic roads, the minimum cover shall be 1.1m. Regardless of the width of the road, only one pipe in the road shall be installed. This practice is based on the assumption that all the plot connections will be made before surfacing the roads.
- The total length of the distribution network has been estimated as 1450m. The cost of the above-mentioned components is presented in Table 4.1.

Wastewater

The waste water system comprises the collection network and manholes. The design of the onsite network was based on the following criteria.

- Sewage production ratio is 0.80 of the water consumption.
- Manning equation is to be used in the hydraulic design of the pipes.

$$V = 1/N R^{2/3} S^{1/2}$$

Where

V= velocity, m/s.

N= coefficient of roughness.

R= hydraulic radius, m.

S= slope of energy grade line, m/m.

The value of N =0.01 was used in the pipe design.

- The pipe material used is UPVC.
- The maximum velocity is 2.4 ms/sec at peak flow.
- Minimum velocity is 0.6m/sec.
- Minimum cover above the pipe is 1.1m.
- Minimum slope is 0.0033 m/m.
- Minimum size of pipes in roads is 200 mm.
- Maximum distance between the manholes should not be more than 50 ms, and the average distance is 30 ms.
- Factory connection is 160 mm in diameter, and each factory should have its own manhole at the set back of the factory.
- Peak factor is 2.0.
- The maximum depth of the flow is 80% of the pipe diameter at peak flow.

Based on the above design criteria, the peak flow was estimated for each pipe and accordingly the size of the pipes has been determined. All the pipes shall be installed underground along the

roads. The pipes are to be located in the carriageway with minimum cover of 1.1m. All the plots' connections should be installed before the surfacing of the roads. Due to the topographical characteristics of the area, the sewage flow shall go into the collection network by gravity. All the collection pipes are 200mm in diameter.

The cost of the onsite sewerage collection system is summarized in Table 4.3.

Table 4.3: Investment costs for onsite sewage collection system

Activities	Unit Price, \$	Quantity	Sub-Total Cost US\$	Operation & maintenance cost/year
Collection system 200 mm UPVC pipes	20	1,450	29,000	580
Manholes of 1m diameter	400	50	20,000	200
Total			49,000	780

4.2 Electricity

Electrical demand

The estimate of the electrical demand was based on the knowledge and experience of the engineering team and on a survey of the electrical needs of similar industrial activities, in addition to actual consumption values recorded for the industrial estates in the region.

The engineering team has conducted a survey for some of the industries that are expected to be found in the GLIE. The survey focused on the under roof area of the factory or workshop coupled with the associated electrical consumption. The average electrical consumption for the surveyed workshops and factories is 37kw per dunum of building area. The electrical consumption in Gaza Industrial Estate that has been calculated from the actual measurements and was found to be 38kw per dunum of building area. These values are listed in Table 4.4.

Table 4.4: Electrical consumption in similar developments

Type of industrial activity	Area of the workshop or factory (dunum)	Total electrical Consumption	demand values (KW/dunum of building area)
Tiling factories	2	70	35
Steel fabrication	0.2	10	50
Steel shaping	0.2	6	30
Furniture	0.3	10	33
Cars maintenance	0.2	7	35
Garments	0.5	20	40
Average of electrical consumption for surveyed activities			37
Gaza Industrial Estate			38

Based on the above figures, the electrical demand for GLIE is estimated as 40kw per dunum of building area assuming that the current constrained consumption will increase if better services are provided. Since the under roof area will be about 45 dunums, the total electrical demand is about 1800kw.

Electrical Supply

According to the Palestinian Energy Authority's (PEA) future plan for supplying the northern part of Gaza Strip with electricity, there is a proposed substation 1.8km to the south of the GLIE site. The construction works for this substation has been completed. The installation of the equipment has been delayed due to the prevailing political conditions in the area, however it is expected to have the substation functioning within few months. PEA could not give confirmed time schedule for the completion of the substation as well as the Gaza Power Plant (GPP). From this substation, there are five planned high-tension lines to be installed; 2 lines will feed GLIE (with 24 MW capacity).

Obviously, the implementation of this plan is pending the operation of GPP. It was expected that the first phase of GPP with a capacity of 48 MW would be functioning by the end of 2000. However, and due to the current unstable political situation, the installation of the equipment at the plant has been delayed. The work has been resumed but no one can confirm the completion date of the plant.

To meet the demand of the first phase of the GLIE, two options are envisaged:

Option 1: the electrical demand can be met from GPP through the northern substation. The electrical company normally incurs these costs. It has to be mentioned that this option can be viable when the substation and GPP are functioning.

Option 2: To provide the electricity by on-site diesel generators. For this purpose, the demand of the first phase will be covered through installing four diesel generators with 600KVA (480KW) capacity each. The provision of the generators can be made in stages depending on the increased demand.

The investment costs that will be needed to cover the offsite installation in the two options are summarized in Table 4.5 below.

Table 4.5: Cost estimate of offsite electrical installations

	Description of items	Quantity	Unit rate US\$	Total Cost US\$	O&M cost
Option 1	Supply & Installation of high poles	34 nos	1,500	51,000	
	Supply & Installation of high voltage wires 50mm ²	8,000m	10	80,000	
	Total Option 1			131,000	
Option 2	1- 600 KVA Diesel Generator	4 nos	70,000	280,000	0.1\$/kWh
	3- Main fuel tank and installation	1 nos	10,000	10,000	
	4- Civil works	Lump sum	10,000	10,000	
	Total Option 2			300,000	

The onsite electrical installations comprise the PVC ducts, electrical manholes, street lighting poles, underground cables, factory connections and transformers. The cost of these items is summarized in Table 4.6 below.

Table 4.6: Electrical works inside the industrial area:

NO.	Description	unit	Qty.	Unit Price	Subtotal US\$
1-	Supply & Install 6" UPVC pipes for ducts	m	8,000	7	56,000
2-	Supply & Install 2" PVC conduit for factory connection	m	5,600	3	16,800
3-	Supply & Install 1m diameter manhole	No.	30	260	7,800
4-	Supply & Install 10M lighting pole with all-necessary conduits, cables, and lanterns.	No.	40	1,200	48,000
5-	Supply & Install 630 KVA transformer including switch gear, circuit breakers and all necessary accessories to complete the job	No.	4	30,000	120,000
	Total				248,600

4.3 Telecommunications

The only option to provide the GLIE with telephone lines is from the Palestinian Telecommunication Company (PalTel). The installation of offsite cables, ducts, and one Remote Subscriber Unit (RSU) are normally incurred by the PALTEL.

The estimated number of telephone lines that are required for the first phase is about 800 lines.

4.4 Storm Water Drainage

The average annual rainwater at GLIE area is about 370 mm, which is the same rainfall quantity as in Gaza City. The area of GLIE is naturally sloping to the northwest; this allows the surface drainage of runoff storm water. The design of the vertical profile of the roads shall take into account the surface drainage of the entire area of GLIE. The existence of the Wadi to the west of the site will serve the area as a natural disposal facility.

4.5 Road Network

As mentioned earlier a detailed master plan was prepared by the MoG on May 12, 2001. This master plan describes the existing and proposed road network for this part of Gaza city around the concerned area. This plan is yet to be officially approved. The proposed widening of the existing roads and the construction of new roads is seen as very useful for the development of the area. The study team suggests following the MoG Plan.

Gaza Local Industrial Estate Engineering Study

However, for the initial phase development few roads are necessary to be either upgraded or constructed to connect the GLIE with the main road network or for the development of the site itself.

Offsite Roads

Two main roads are necessary to connect the initial phase of the proposed GLIE with the road network. These roads are presented in Figure 2.9 and described below:

Road R1

This is the main access road to the proposed GLIE site. It branches from El Karama Road. Currently it is constructed to have only 8m of paved width. It is required to be widened to 30m reaching its total planned width. However, an initial development of about 20m wide might be sufficient. It should be noted that there is a bridge on this road over El Qashash Wadi, which might require upgrading. The current width of the bridge is about 9m. In case of widening Road R1, the bridge should be widened as well. The total length of this road that is necessary to be upgraded for the initial phase is about 300m only.

Road R4

This is the second main access road to the proposed GLIE site. This road is currently a sandy road. However, it is included in the master plan prepared by the MoG. It has a 20m width. This road is preferred to be constructed to make the access to the GLIE even easier. However, it might also be delayed for a next phase as the initial phase is not too large and Road R1 might be sufficient. The total length that require development for the benefit of the initial phase is about 300m.

Table 4.7: Summary of Proposed Offsite Roads

Road Name	Road #	Width (m)	Length (m)	Notes
The GLIE Main Access Road	R1	30	300	Also proposed by MoG
Second Access Road	R4	20	300	Also proposed by MoG

Table 4.8: Estimated Cost of Offsite Roads

Road Name	Road #	Width m	Length m	Area m2	Unit Cost \$/m2	Total Cost
The GLIE Main Access Road	R1	30	300	9,000	20	180,000
Second Access Road	R4	20	300	6,000	20	120,000
Total				15,000		300,000

Gaza Local Industrial Estate Engineering Study

Onsite Roads

A network is suggested for onsite roads in the GLIE. It is suggested to use the grid system. The suggested road width is 12m, Taking into consideration the 5m setback at the front of each plot. This setback will increase the effective width of the road allowing for parking as well as loading and unloading activities without disturbing the traffic flow on the roads.

The roads are planned in a grid system in order to provide easy and direct access to all industrial units. The road hierarchy system is selected to provide efficient and economical infrastructure facilities. The total length of onsite roads is expected to be about 1,500m.

Table 4.9: Estimated Cost of Onsite Roads

Road Name	Width (m)	Length m	Area m ²	Unit Cost \$/m ²	Total Cost
Onsite roads	12	1,500	18,000	20	360,000

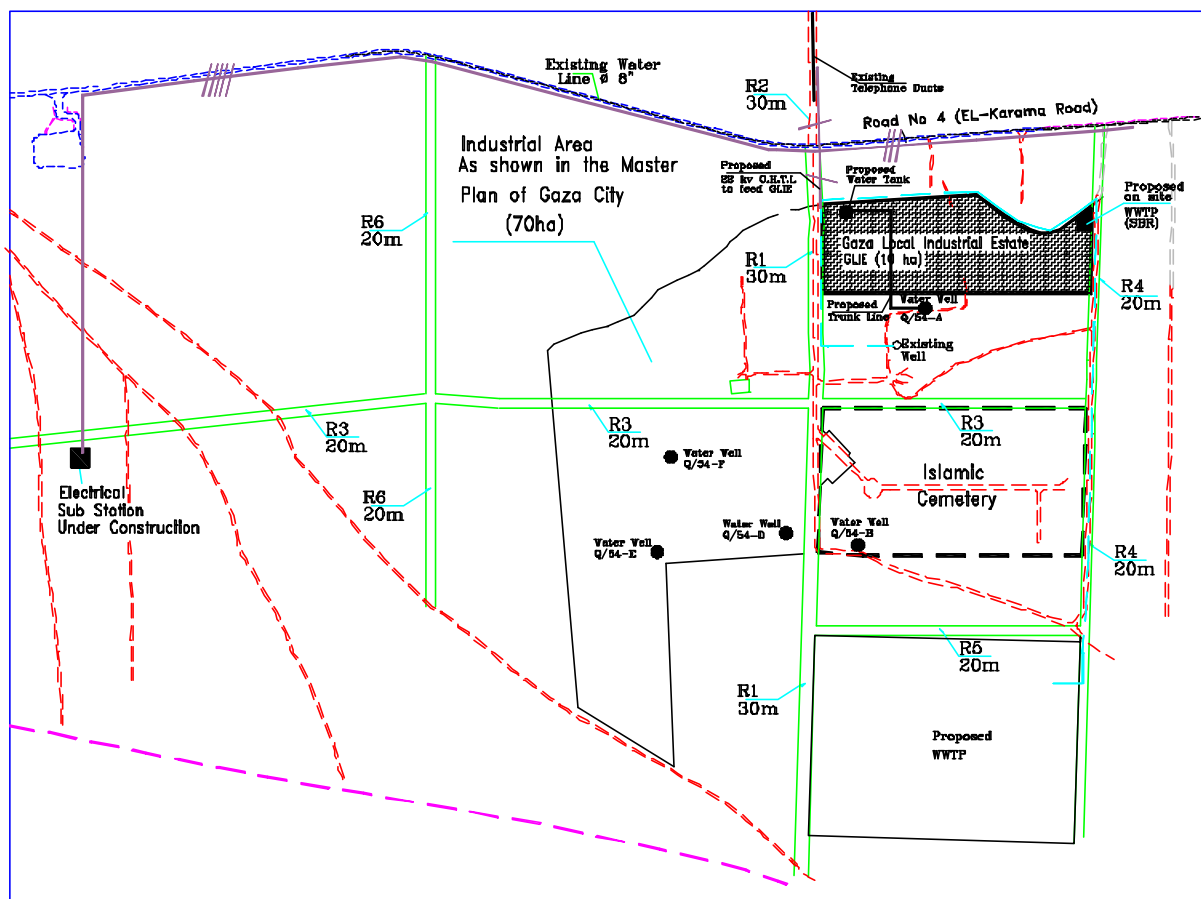


Figure 4.1: Proposed Offsite Infrastructure

5. Cost Estimates

5.1 Cost Assumptions

This Section shows the estimated capital investment required for the development of the initial phase of the GLIE. The cost estimates of off-site infrastructure, on-site infrastructure, industrial buildings, and the administration buildings have been prepared based on prevailing current costs in the Gaza Strip. However, it is important to note that detailed engineering designs must be used for construction and tendering purposes. The costs might fluctuate slightly based on local market conditions in terms of material prices, workmanship cost, and supply and demand in the construction industry.

Typical Buildings

The buildings are proposed to be constructed of steel structures for the workspace and of concrete structure for the service and administration areas.

The total floor space for each industrial building is 648 m². Each building has the flexibility to be divided into four units of about 162 m² each. The 162 m² may also be divided into two separate units.

Buildings should be well designed to suit the types of industries. Particular attention should be paid for providing adequate ventilation for the buildings.

The cost estimation assumes that the most majority of the construction materials will be locally available, or can be obtained at the current level of prices.

During construction stages, the cost of excavation and hauling waste material to dumping sites was considered and included in the cost of civil works. Also, the cost of having a green belt at the western side of the GLIE was included in the landscaping and green areas.

To calculate the custom duties, it is assumed that 70% of the total cost for construction is composed of material cost and 30% of it is labor cost. Since locally available material (such as cement, aggregates, sand, UPVC pipes, corrugated steel sheets, reinforcement bars) do not have any custom taxes associated with them, the calculations will be based on custom duties that will reflect the impact of imported items on the total cost of construction.

The unit prices presented includes the Value Added Tax of %17.

5.2 Detailed Capital Costs

The main costs associated with the development of the initial phase of GLIE are presented in this section. The following subsections outline the costs of the different elements considered.

Off-site infrastructure

Table (5.1) sets out the costs of offsite infrastructure facilities for initial phase development. The costs of constructing roads, water supply, wastewater, electricity, and telecommunications are included. All of the offsite infrastructure will be implemented at this stage.

Table (5.1) Cost Summary of Off-Site Infrastructure

Item	Total Price (\$)	Customs Duties	VAT	Total Price (\$) without Customs or VAT
A. Roads	300,000	2%	17%	243,000
B. Water supply	369,500	2%	17%	299,295
C. Wastewater	615,000	5%	17%	479,700
D. Electricity	300,000	0%	17%	249,000
E. Telecommunication	To be paid by PalTel			
Total	1,584,500			1,270,995

On-site infrastructure

Table (5.2) identifies the costs of on-site infrastructure of initial development phase.

Table (5.2) Cost Summary of On-Site Infrastructure

Item	Total price (\$)	Customs Duties	VAT	Total Price (\$) without Customs or VAT
A. Roads	360,000	2%	17%	291,600
B. Water lines	32,500	1%	17%	26,650
C. Waste water	49,000	0%	17%	40,670
D. Electricity	248,600	0%	17%	206,338
E. Telecommunication	To be paid by Pal Tel	---	---	---
Total	690,100			565,258

Gaza Local Industrial Estate Engineering Study

Table (5.3) Estimated Cost for Gaza Local Industrial Estate Buildings

No.	Item Description	Unit	Quantity	Unit Price (\$)	Total Price (\$)	Customs Duties	VAT	Total Price (\$) without VAT or Customs
	Initial Development							
DATA								
	Site area	ha	10					
	Industrial buildings	m2	41,472					
	Administration Building	m2	1200					
COSTS								
A	Industrial buildings cost							
1	Basic cost	m2	41,472	150	6,220,800	2%	17%	5,038,848
B	Administration building cost							
1	Basic cost	m2	1200	250	300,000			
2	Furniture	Lump sum	1	50,000	50,000			
	Sub Total				350,000	7%	17%	266,000
	Total Building cost (Parts A+B)				6,570,800			5,304,848
C	Other Onsite Costs							
	Roads	m2	9000	20	180000			
	Sidewalks	m2	6000	15	90000			
	Parking	m2	2000	20	40000			
	Gardening	m2	6000	10	60000			
	Total of Other Onsite Costs				370,000	2%	17%	299,700
	TOTAL COST Initial Development Phase (Parts A+B+C)				6,940,800			5,604,548

Table (5.5) Summary of Capital Budget Costs

Item Description		Capital Budget Cost (\$)	Total Price (\$) without Customs or VAT
1.	Offsite Infrastructure		
	Roads	300000	243000
	Water	369500	299295
	Waste Water	615000	479700
	Electricity	300000	249000
	Telecommunications	0	0
	SUB TOTAL 1	1,584,500	1,270,995
2.	Onsite Infrastructure		
	Roads	360000	291600
	Water	32500	26650
	Waste Water	49000	40670
	Electricity	248600	206338
	Telecommunications	0	0
	SUB TOTAL 2	690,100	565,258
3.	Industrial Estate Buildings	6,940,800	5,604,548
	SUB TOTAL 3	6,940,800	5,604,548
	Total Capital Budget Costs	9,215,400	7,440,801
4.	Design fees (4% of subtotal)	368,616	
5.	Supervision & management fees (6% of subtotal)	552,924	
	TOTAL	10,136,940	
6.	Physical Contingency (10% of total)	1,013,694	
	GRAND TOTAL	11,150,634	

5.3 Recurrent Costs

The developer of the GLIE will incur the operation and maintenance costs of the following items:

- Internal road networks
- Street lighting
- Water distribution networks, reservoirs

- Waste water collection system, pumping station and WWTP
- Internal power distribution system
- Landscaping
- Exteriors of the units buildings

The annual operating costs are calculated using a percentage (a range of 0.5% to 2%) of the total construction costs. It is also assumed that two crews will be on site, an operational and maintenance department and an administrative and services department. The operation and maintenance department will probably require a personnel of 7 people. The administrative and services department will require about a personnel of 5 people. The costs associated with operating the Services buildings are not fully included and assumed that part of the operating costs of the facilities will be covered by charging the beneficiaries.

Operation and Maintenance Cost

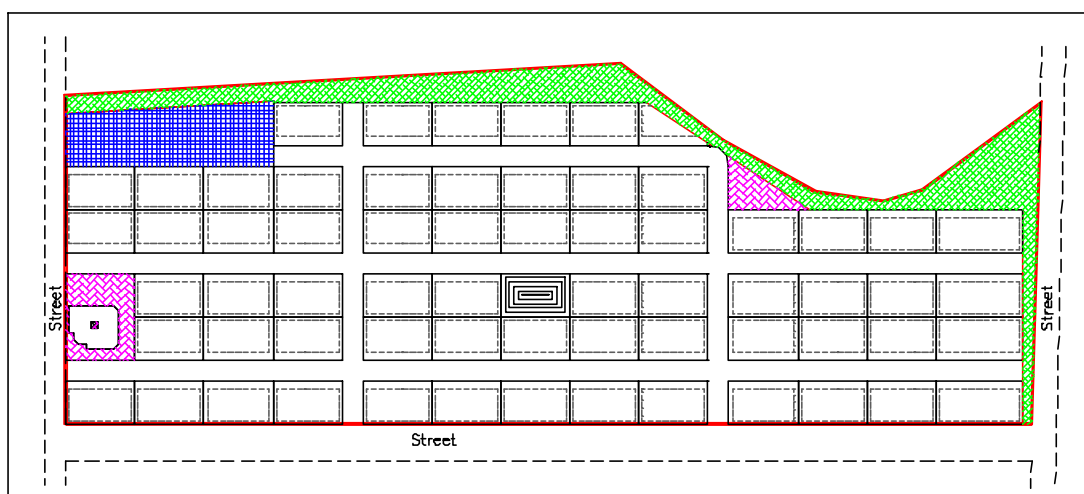
Table (5.6) Summary of Annual Operation and Maintenance Costs

No.	Item Description	Annual Operation & Maintenance Cost (\$)
1.	Offsite Infrastructure	
	Roads	6000
	Water	13600
	Waste Water	29300
	Telecommunications	0
	Electricity	‘0.1\$/kwh
	SUB TOTAL 1	48,900
2.	Onsite Infrastructure	
	Roads	7,200
	Water	650
	Waste Water	780
	Electricity	4,970
	Telecommunications	0
	SUB TOTAL 2	13,600
	GRAND TOTAL	62,500

**The Services Group
TSG-PRIZM Project**

**GAZA LOCAL INDUSTRIAL ESTATE
ENGINEERING STUDY**

**ANNEX A
PROJECT SUMMARY TEMPLATE**



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ANNEX A: Project Summary Template

Category	Site Attribute
EXISTING SITE	
Physical site	<ul style="list-style-type: none"> The site falls within the jurisdiction of Gaza Municipality. It is located at the northeast administrative boundary of Gaza City.
Size	<ul style="list-style-type: none"> Total area = 73 hectares, Initial phase area = 10ha
Relative location	<ul style="list-style-type: none"> Distance to downtown of Gaza city: 4 kilometers Distance to Jabalia center: 2 kilometers Distance to Erez Industrial Zone: 7 kilometers Distance to Gaza Industrial Estate: 5 kilometers Distance to Gaza International Airport: 40 kilometers Distance to proposed Gaza Seaport: 13 kilometers
Ownership	<ul style="list-style-type: none"> The piece of land belongs to the Islamic Waqf, which is managed by the Ministry of Al Waqf and Religious Affairs (MoWRA). It was leased to local farmers for cultivation and other uses, however the lease contracts were due to end by the 30th of June 1998. The area is allocated by the master plan prepared by the Municipality of Gaza to be used as an industrial area.
Existing structures	<p>There are a few existing structures on the entire proposed site for GLIE. These include:</p> <ul style="list-style-type: none"> A sheep farm (about 6,600m²); A cow farm with associated structures and six greenhouses Three wooden sheds (3x3m) 5 Water wells New greenhouses were being constructed on part of the land. <p>However, the proposed first phase of 10 ha is free of any existing structure.</p>
Grade and drainage	<ul style="list-style-type: none"> The area is gently sloping towards the northwest leading to El Qashash Wadi. In general, the northwest side of the proposed GLIE is the lowest part of the area. The Wadi provides a natural drainage to the site. In some wet seasons, the surrounding areas have been subjected to flooding from the Wadi.
Soil conditions	<ul style="list-style-type: none"> The first layer stratum is stiff silty clay, located immediately below topsoil and has a depth of about 7-23m below ground level. Below the clay, the Kurkar formation is encountered consisting of fine to medium grained sand, with minor amounts of gravel and silt.
Water table	<ul style="list-style-type: none"> The ground water table is located at around 48-50m below the ground surface. The depth of water table has been estimated from the static water level of wells Q54-A and Q54-D, which are located within the site.
Road access	<p>Existing Roads</p> <ul style="list-style-type: none"> The Shuhada Islamic Cemetery Street is the main access road to the proposed GLIE site. It branches from El Karama Road. Its planned width is 30m wide, currently paved 8m wide only.

Gaza Local Industrial Estate Engineering Study

Category	Site Attribute
	<ul style="list-style-type: none"> Salah Dardoana Street (30m wide) leads to the proposed GLIE site from the west and connects the site with Salah El Din road. <p><u>Proposed Roads by MoG</u></p> <ul style="list-style-type: none"> A proposed road by the detailed master plan prepared by the MoG crosses the Industrial Area from the north to the south and continues south reaching the existing Gaza Industrial Estate at Karni. It is planned to be 20m wide. The MoG also proposes other roads around the site each has a 20m width.
Water supply	<p><u>Water wells</u></p> <ul style="list-style-type: none"> There are 5 agricultural wells drilled within the site boundary, designated Q54-A, B, D, and E. The chemical test results show that the chloride level is about 370 mg/l, (in wells Q54-A and Q54-D) which is above the WHO maximum Standard (250mg/l). The nitrate content is of acceptable levels (less than 50 mg/l). <p><u>Water pipelines</u></p> <ul style="list-style-type: none"> A Municipal pipeline of 8" in diameter is passing along road No 4 and connects a municipal well in Jabalia with a residential area in Gaza City. The pipeline is about 200m to the west from the proposed site It has a capacity of 200m³/hr. The information obtained from Gaza Municipality demonstrates that it is not allowed to supply the proposed GLIE with water from this pipeline.
Wastewater	<p><u>Existing Condition</u></p> <ul style="list-style-type: none"> The area to the east of Road No.4, including the proposed site for GLIE and the neighboring areas, is not served by a conventional sewage system. The nearest point at which sewage network exists is located 1.5kms to the south from the proposed site. The capacity of this sewer network may not be adequate to receive the generated wastewater from the GLIE. The sewage collected from Gaza is discharged to a treatment plant at the Sheikh Ejeen area, 10 km to the southwest from the GLIE site. The daily influent that comes to Gaza Wastewater Treatment Plant (WWTP) is about 40,000 m³/day. According to MOG, the design capacity of the treatment plant is 40,000m³/day. The plant is designed for a maximum flow rate of 50,000 m³/day. The maximum-recorded inflow during the winter was about 60,000 m³/day.
Electricity	<ul style="list-style-type: none"> Gaza Strip is currently supplied with electricity from Israel through 11 high-tension lines (22 KVA each). Two of those lines are allocated for use of the Israeli settlements and 9 lines are supplying the residents of Gaza Strip. The maximum permissible load for each of the above high-tension lines is 11MW. Five high-tension lines are feeding the Gaza City in addition to the Northern Gaza Governorate. The nearest high-tension line is 1.5km from the GLIE site and known as EL Sha'af Line. The second closest high-tension line is located along Salah El Dein road

Gaza Local Industrial Estate Engineering Study

Category	Site Attribute
	<p>2km to the west of the GLIE site.</p> <ul style="list-style-type: none"> The Palestinian Energy Authority acknowledged that the existing high-tension lines that feed Gaza are at present overloaded and do not have the capacity to meet any additional demand.
Telecommunications	<ul style="list-style-type: none"> There is a main Fiber Optic Cable located at Salah El Dein road 2 km to the west of the GLIE site. There are also telephone conduits installed at Salah Dardouna Road that connects Salah El Dein road with road No. 4. The end of these conduits is 200m far from the GLIE site.
Initial development	<ul style="list-style-type: none"> The general location of the site selected for the initial development is at northwest side of the total area. It has a gross area of 10 hectares.
DEVELOPMENT	
Gross/net land yield	<ul style="list-style-type: none"> Percentage of land available for plots = 65%
Floor area ratio	<ul style="list-style-type: none"> Percentage of plot under roof = 65%
Under roof area	<ul style="list-style-type: none"> 41,472 square meters
Average unit	<ul style="list-style-type: none"> 242 square meters
Number of units	<ul style="list-style-type: none"> 171
IMPROVEMENTS	
Site preparation	<ul style="list-style-type: none"> Site acquisition and minor earth works.
Road access	<ul style="list-style-type: none"> An 8m wide road is available and can be used as an access road to the GLIE. This road is required to be widened and upgraded. Another access road to the north of the site can enhance the accessibility to the site. This road needs to be constructed. The length of each access road of the above is about 300m only.
Water supply	<ul style="list-style-type: none"> The GLIE can be supplied with water from the existing water wells in the site. Upgrading of the well Q54-A The installation of 160mm in diameter UPVC pipe from the well to the elevated tank with a length of 300 m. The construction of an elevated tank with a capacity of 300 m³ and height of 30 m above grade level. Water distribution network piping 160mm in diameter UPVC including valves & fittings
Wastewater	<p>Option 1</p> <ul style="list-style-type: none"> On site Treatment plant (SBR) (200m³/day) Pumping station for treated sewage Q= 130m³/day & H=15 ms Pressure line 1000ms long, 160mm diameter UPVC for reuse of treated water Collection system 200 mm UPVC pipes 1450m 50 Manholes of 1m diameter
Electricity	<p>The total electrical demand is about 1800kw. This demand can be met from the Gaza Power Plant which will be functioning soon. The following installation should be made offsite and on site to provide the GLIE with electricity.</p> <ul style="list-style-type: none"> Installation of 34 high poles Installation of 8000 high voltage wires 50mm²

eAnnex A Project Summary

Gaza Local Industrial Estate Engineering Study

Category	Site Attribute
	<ul style="list-style-type: none"> ▪ Installation of 8000m 6" UPVC pipes for ducts ▪ Installation of 5600m 2" PVC conduit for factory connection ▪ Installation of 30Nos 1m diameter manhole ▪ Installation of 40Nos 10M lighting pole with all-necessary conduits, cables, and lanterns. ▪ Installation of 4Nos of 630 KVA transformer including switch gear, circuit breakers and all necessary accessories to complete the job
Telecommunications	<ul style="list-style-type: none"> ▪ The only option to provide the GLIE with telephone lines is from the Palestinian Telecommunication Company (PalTel). The installation of offsite cables, ducts, and one Remote Subscriber Unit (RSU) are normally incurred by the PALTEL. ▪ The estimated number of telephone lines that are required for the first phase is about 800 lines.
Facilities	<ul style="list-style-type: none"> ▪ Administration building ▪ A mosque, common storage and meeting rooms ▪ Car parks ▪ Green area
Security	<ul style="list-style-type: none"> ▪ A fence and a gate are recommended.